

**REMARKS/ARGUMENTS**

Reconsideration and allowance in view of the foregoing amendment and the following remarks are respectfully requested.

Claims 1-7 and 9-18 are now pending.

The Examiner objected to the Inventor's Declaration as including non-initialed and/or non-dated alterations. Reconsideration is respectfully requested. It is respectfully noted in this regard that the only alteration is the line through of a hand written addition. Therefore, ultimately, there has been no alteration of the Declaration. Therefore, reconsideration is requested. Furthermore, the undersigned has been advised that the first named inventor, Mr. Toshihiko Igashira, has died. Accordingly, a new Declaration has been executed by Mr. Igashira's legal representative and by the surviving inventor. In the event the Examiner remains of the view that a new Declaration is required, the new Declaration is attached.

The Abstract was objected to as exceeding 150 words in length. The Abstract has been reviewed and revised above so as not to exceed 150 words. Reconsideration and withdrawal of the objection are requested.

Claims 1-8 and 10-12 were rejected under 35 USC 102(e) as anticipated by or, in the alternative, under 35 USC 103(a) as obvious from Igashira et al (6,679,440). At the outset, it is respectfully noted that the invention claimed in the present application is commonly owned with the Igashira et al '440 patent. Because this application and the cited patent are commonly owned, the '440 Igashira patent does not constitute statutory prior art with respect to this application under Section 103/102(e). Therefore, to the extent the Examiner rejects these claims in the alternative under 35 USC 103, it is respectfully submitted that the rejection is improper and should be withdrawn.

Applicant respectfully traverses the Examiner's rejection under 35 USC 102(e). Although the structure disclosed in the present application includes certain similarities

to that disclosed in the '440 Igashira et al patent, the cited '440 patent is silent in regard to setting of a valve-opening pressure.

By way of background, the invention was made to minimize the size of the piezoelectric actuator. Generally, a decrease in size, e.g., a decrease in overall length, of the actuator results in a decrease in the displacement or stroke of the actuator upon application of voltage thereto, thereby improving the reliability of the actuator, reducing mechanical vibrations or noise of the fuel injector, and allowing the size of the fuel injector to be decreased.

However, a decrease in the stroke of the actuator upon application of voltage thereto results in a lack of pressure to open or close a high and a low-pressure port (32,31), and difficulties in fuel injection.

The low pressure port-opening valve force (i.e., hydraulic pressure acting on a control valve (i.e., ball valve 52) is set by determining diameters of an input orifice and an output orifice leading to a control chamber (51) (i.e., a flow rate) from a target upward or downward movement speed of a nozzle needle (12) to determine an opened area of the control valve (52) (i.e., a diameter of a circular line of contact between the control valve (52) and a seat surface (i.e., 53) times an interval between the control valve and the seat surface at the contact). The low pressure port-opening valve force acting on the control valve (52) is given by a sectional area of the portion of the control valve (52) abutting the seat surface times working pressure per unit area. When the low pressure port-opening valve force lies within an output range of the piezoelectric actuator, a desired fuel injection is achieved. The actuator may be used in a condition that the output force of the actuator produced when undergoing a maximum required load is more than one-half of a maximum possible output force thereof. The high pressure port-opening valve force also depends upon a target downward movement speed of the nozzle needle. When it lies within the output range of the actuator, the

desired fuel injection is achieved (see attached Figure 1, submitted herewith for informational purposes).

Decreasing the length of the actuator, as described above, results in a decrease in displacement or stroke of the actuator unless the applied voltage is changed. The applicant's structure is, thus, needed to determine the high pressure port-and low pressure port-opening valve forces which maximize actuator characteristics. Specifically, the output force of the actuator when opening the high pressure port is selected to be one-half of the maximum possible output force thereof. When the limit of the actuator output characteristics is used to open the low pressure port, closing of the high pressure port after the low pressure port is opened is achieved by selecting the high pressure port-closing valve force to be lower than the low pressure port-opening valve force within the output range of the actuator (see attached Figure 2 submitted herewith for informational purposes). However, in an actual operation of the actuator, during a time interval between the low pressure port opening and the high pressure port closing, an actual stroke of the actuator is smaller than that derived mathematically by the actuator characteristic because the hydraulic load continues to act on the actuator. A lack of such an actuator stroke results in difficulty in closing the high pressure port. Therefore, the applicant's structure is so designed that the low pressure port-opening valve force (i.e., the hydraulic pressure required to open the fluid port in claim 1) is determined to be lower than one-half of the maximum possible output force of the actuator in order to close the high pressure port, thereby achieving a stroke of the actuator required to close the high pressure port (see attached Figure 3 submitted herewith for informational purposes).

For the foregoing reasons, it is respectfully submitted that the claimed invention is not anticipated by Igashira et al '440.

Claims 1-8 and 10-12 were also rejected under 35 USC 102(b) as anticipated by or, in the alternative, under 35 USC 103(a) as obvious over Hays, Jr. Applicant respectfully traverses this rejection.

Hays, Jr. is silent in regard to the above-discussed feature of the invention, now even more particularly recited in independent claims 1 and 4. It is therefore respectfully submitted that the claimed invention is not anticipated by nor obvious from Hays, Jr. either.

Applicant notes with appreciation the Examiner's indication that claim 9 contains allowable subject matter. Claim 9 has been presented in independent form and the dependency of claim 10 has been amended accordingly. Claim 8 has been canceled in view of the amendment to claim 9. It is therefore respectfully submitted that claims 9 and 10 should now be allowed. Further, claim 11 has been amended to incorporate the limitations of allowable claim 9, so that it is respectfully submitted that claim 11, and claim 12 depending therefrom, should now be allowed as well.

All objections and rejections having been addressed, it is respectfully submitted that the present application is in condition for allowance and an early Notice to that effect is earnestly solicited.

Respectfully submitted,

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